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Abstract

THE DIRECT CONVERSION OF HEAT INTO ELECTRICITY IN REACTORS

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The direct conversion of heat into electricity by thermionic emission in an atomic reactor has been studied with the triple aim of its utilisation : as an energy source for a space device, at the head of a conventional conversion system in power installations, or finally in association with the thermoelectric conversion in very low power installations.

The laboratory experiments were mainly orientated towards the electron extraction of metals and compounds and their behaviour at high temperatures.

Converters furnishing up to 50 amps at 0.4 volts with an efficiency close to 10 p. 100 have been constructed in the laboratory ; the emitters were heated by electron bombardment and were composed of tungsten covered with an uranium carbide deposit or molybdenum covered with cesium.

The main aspects of the coupling between the converter and the reac-

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tor have been covered from the point of view of electronics : the influence of the mismatching of the load on the temperature of the emitter and the influence of thermal flux density on the temperature of the emitter and the stability of the converter.

Converters using uranium carbide as the electron emitter have been tested in reactors. Tests have been made under dynamic conditions in order to determine the dynamic characteristics.

The load matching curves have been constructed and the overall performances of several cells coupled in such a way as to form a reactor rod have been deduced.

This information is fundamental to the design of a control system for a thermionic conversion reactor.

The problems associated with the reliability of thermionic converters connected in series in the same reactor rod have been examined theoretically.

Finally, the absorption isothermals have been drawn at the ambient temperatures for krypton and xenon on activated carbon with the aim of investigating the escape of fission products in a converter.